Gas Leak on Converter 1st Pass Outlet

P/P_A = 1.442 less than 1.893 $[(k+1)/2]^{k/(k-1)}$ therefore the flow is non-choked (i.e. **subsonic**), **AND** the following equation applies

$$Q = C A P \sqrt{\left(\frac{2 g_c M}{Z R T}\right)\left(\frac{k}{k-1}\right)\left[\left(\frac{P_A}{P}\right)^{2/k} - \left(\frac{P_A}{P}\right)^{(k+1)/k}\right]}$$

				psia	psig	in WC
Q = mass gas flow (lbs/s)			K = C_p/C_v of the gas	1.4		
C = discharge coefficient	0.65		P = source pressure absolute (lb/ft^2)	3053	21.2	6.5	180
Equivalent Diameter of hole (in)	**0.25**		P_A = ambient pressure absolute (lb/ft^2)	2117	14.7		
A = area of hole (ft^2)	0.00034		M = molecualr weight of gas	34		
g_c = gravitational constant (ft/s)	32.17		Z = compressibility factor	1.07706293		
R = gas constant (ft-lb/lb mol - °R)	1543.3		Release duration (seconds)	86,400		
T = temperature (°R)	1593	612 °C	SO_3 concentration in gas (wt%)	**19**	**See Notes below for comment regarding calculations**	
Molecular weight of SO_3	80		SO_2 concentration in gas (wt%)	**5**	**See Notes below for comment regarding calculations**	
			Molecular weight of SO_2	64		

Intermediate Calculations:

0.000826
3.5
0.59263
0.533753
0.676132

Mass Calculations:

Q =	0.0088 lbs/s
Total mass:	762 lbs
Total SO_3 mass:	145 lbs
Total SO_2 mass:	38 lbs

Reference: "Perry's Chemical Engineering Handbook, 6th Edition, McGraw-Hill 1984"

SO_3/SO_2 concentration in gas 10.1 mol% according to DCS immediately prior to start of leak.

SO_3/SO_2 design concentration in gas 10.7 mol% (8% SO3 and 2.7% SO2).

Therefore SO_3 concentration is 75% of total SO_3/SO_2 = 10.1 x 75% = 7.6% x 80/100 = 6.1 wt%.

Therefore SO_2 concentration is 25% of total SO_3/SO_2 = 10.1 x 25% = 2.5% x 64/100 = 1.6 wt%.

This is NOT the way to calculate wt% from vol%